K = 1.4, the configuration factor for a conductor-to-conductor gap.

(2) The value of D shall be increased 3% for each 1000 ft (300 m) in excess of 1500 ft (450 m) above mean sea level.

b. Limit

The clearance derived from Rule 235B3a shall not be less than the basic clearances given in Table 235-1 computed for 169 kilovolts alternating current.

C. Vertical Clearance Between Line Conductors

All line wires, conductors, and cables located at different levels on the same supporting structure shall have vertical clearances not less than the following.

1. Basic Clearance for Conductors of Same or Different Circuits

The clearances given in Table 235-5 shall apply to line wires, conductors, or cables of 0 to 50 kV attached to supports. No value is specified for clearances between conductors of the same circuit exceeding 50 kV.

EXCEPTION 1: Line wires, conductors, or cables on vertical racks or separate brackets placed vertically and meeting the requirements of Rule 235G may have spacings as specified in that rule.

EXCEPTION 2: Where communication service drops cross under supply conductors on a common crossing structure, the clearance between the communication conductor and an effectively grounded supply conductor may be reduced to 4 in (100 mm) provided the clearance between the communication conductor and supply conductors not effectively grounded meets the requirements of Rule 235C as appropriate.

EXCEPTION 3: Supply service drops of 0–750 V running above and parallel to communication service drops may have a spacing of not less than 12 in (300 mm) at any point in the span including the point of and at their attachment to the building provided the non-grounded conductors are insulated and that the clearance as otherwise required by this rule is maintained between the two service drops at the pole.

EXCEPTION 4: This rule does not apply to conductors of the same circuit meeting Rule 230D.

2. Additional Clearances

Greater clearances than those required for 50 kV in Table 235-5 (Rule 235C1) shall be provided under the following conditions. The increases are cumulative where more than one is applicable.

a. Voltages Exceeding 50 Kilovolts

(1) For voltages between 50 and 814 kilovolts, the clearance between conductors of different circuits shall be increased 0.4 in (10 mm) per kilovolt in excess of 50 kV.

EXCEPTION: For voltages to ground exceeding 98kV alternating current or 139 kV direct current, clearances less than those required above are permitted for systems with known switching surge factors. (See Rule 235C3.)

(2) The increase in clearance for voltages in excess of 50 kV specified in Rule 235C2a(1) shall be increased 3% for each 1000 ft (300 m) in excess of 3300 ft (1000 m) above mean sea level.

(3) All clearances for lines over 50 kV shall be based on the maximum operating voltage.

(4) No value is specified for clearances between conductors of the same circuit.

b. Conductors of Different Sags on Same Support

(1) Line conductors, supported at different levels on the same structures shall have vertical clearances at the supporting structures so adjusted that the clearance at any point in the span shall be not less than any of the following with the upper conductor at final unloaded sag at the maximum temperature for which the conductor is designed to operate, or at final sag, with radial thickness of ice, if any, specified in Rule 250B for the loading district concerned, whichever produces the greater sag, and the lower conductor at final unloaded sag under the same ambient conditions and without electrical loading.

(a) For voltages less than 50 kilovolts between conductors, 75% of that required at the supports by Table 235-5.

EXCEPTION: Neutral conductors meeting Rule 230E1 and supply cables meeting Rule 230C1 running above and parallel to communication cables where the supply neutral or messenger is bonded to the communication messenger, may have a clearance of 12 in (300 mm) at any point in the span provided that a clearance of 30 in

(0.75 m) is maintained between the supply conductors and cables and the communication cables at the supporting poles.

(b) For voltages more than 50 kilovolts between conductors, the value specified in Rule 235C2b(1)(a) increased in accordance with Rule 235C2a.

(2) Sags should be readjusted when necessary to accomplish the foregoing, but not reduced sufficiently to conflict with the requirements of Rule 261H2. In cases where conductors of different sizes are strung to the same sag for the sake of appearance or to maintain unreduced clearance throughout storms, the chosen sag should be such as will keep the smallest conductor involved in compliance with the sag requirements of Rule 261H2.

(3) For span lengths in excess of 150 ft (45 m), vertical clearance at the structure between open supply conductors and communication cables or conductors shall be adjusted so that under conditions of conductor temperature of 60 °F (15 °C), no wind displacement and final unloaded sag, no open supply conductor of over 750 volts but less than 50 kilovolts shall be lower in the span than a straight line joining the points of support of the highest communications cable or conductor.

EXCEPTION: Effectively grounded supply conductors associated with systems of 50 kilovolts or less need meet only the provisions of Rule 235C2b(1).

3. Alternate Clearances for Different Circuits Where One or Both Exceed 98 Kilovolts, Alternating Current, or 139 Kilovolts Direct Current to Ground

The clearances specified in Rules 235C1 and 235C2 may be reduced for circuits with known switching surge factors, but shall not be less than the crossing clearances required by Rule 233C3.

D. Diagonal Clearance Between Line Wires, Conductors, and Cables Located at Different Levels on the Same Supporting Structure

No wire, conductor, or cable may be closer to any other wire, conductor, or cable than defined by the dashed line in Fig 235-1, where V and H are determined in accordance with other parts of Rule 235.

E. Clearances in Any Direction from Line Conductors to Supports, and to Vertical or Lateral Conductors, Span or Guy Wires Attached to the Same Support

1. Fixed Supports

Clearances shall be not less than those given in Table 235-6.

EXCEPTION: For voltages exceeding 98 kilovolts alternating current to ground or 139 kilovolts direct current to ground, clearances less than those required by Table 235-6 are permitted for systems with known switching surge factor. (See Rule 235E3.)

2. Suspension Insulators

Where suspension insulators are used and are not restrained from movement, the clearance shall be increased so that the string of insulators may swing transversely throughout a range of insulator swing up to its maximum design swing angle without reducing the values given in Rule 235E1. The maximum design swing angle shall be based on a 6 pounds per square foot (290 Pa) wind on the conductor at final sag at 60 °F (15 °C). This may be reduced to a 4 pounds per square foot (190 Pa) wind in areas sheltered by buildings, terrain, or other obstacles. The displacement of the wires, conductors, and cables shall include deflection of flexible structures and fittings, where such deflection would reduce the clearance.

3. Alternate Clearances for Voltages Exceeding 98 kV Alternating Current to Ground or 139 kV Direct Current to Ground

The clearances specified in Rules 235E1 and 235E2 may be reduced for circuits with known switching surge factors but shall not be less than the following.

Table 235-5 Vertical Clearance Between Conductors at Supports

IN

(When using column and row headings, voltages are phase to ground for effectively grounded circuits and those other circuits where all ground faults are cleared by promptly de-energizing the faulted section, both initially and following subsequent breaker operations. See the definitions section for voltages of other systems.)

Conductors usually at upper levels / Conductors usually at lower levels	Supply cables meeting Rule 230C1, 2, or 3; neutral conductors meeting Rule 230E1 (in)	Open supply conductors		
			Over 8.7 to 60 kV	
		0 to 8.7 kV (in)	Same utility ① (in)	Different utilities ① (in)
1. Communication conductors				
a. Ordinary	40 ①④	40	40	40 plus 0.4 per kV ⑦ over 8.7 kV
b. Used in operation of supply lines	16	16 ③	40	40 plus 0.4 per kV ⑦ over 8.7 kV
2. Supply conductors				
a. 0 to 750 V; supply cables meeting Rule 230C1, 2, or 3; neutral conductors meeting Rule 230E1	16	16 ③	16 plus 0.4 per kV ⑦ over 8.7 kV	40 plus 0.4 per kV ⑦ over 8.7 kV
b. Over 750 V to 8.7 kV		16 ③	16 plus 0.4 per kV ⑤⑦ over 8.7 kV	40 plus 0.4 per kV ⑦ over 8.7 kV
c. Over 8.7 kV to 22 kV				
(1) If worked on alive with live-line tools and adjacent circuits are neither de-energized nor covered with shields or protectors			16 plus 0.4 per kV ⑦ over 8.7 kV	40 plus 0.4 per kV ⑦ over 8.7 kV
(2) If not worked on alive except when adjacent circuits (either above or below) are de-energized or covered by shields or protectors, or by the use of live-line tools not requiring linemen to go between live wires			16 plus 0.4 per kV ④⑦ over 8.7 kV	16 plus 0.4 per kV ④⑦ over 8.7 kV
d. Exceeding 22 kV, but not exceeding 50 kV			16 plus 0.4 per kV ⑤⑦ over 8.7 kV	16 plus 0.4 per kV ⑤⑦ over 8.7 kV

① Where supply circuits of 600 V or less, with transmitted power of 5000 W or less, are run below communication circuits in accordance with Rule 220B2 the clearance may be reduced to 16 in.

② This shall be increased to 40 in when the communication conductors are carried above supply conductors unless the communication-line-conductor size is that required for grade C supply lines.

③ Where conductors are operated by different utilities, a vertical clearance of not less than 40 in is recommended.

④ These values do not apply to conductors of the same circuit or circuits being carried on adjacent conductor supports.

⑤ May be reduced to 16 in where conductors are not worked on alive except when adjacent circuits (either above or below) are de-energized or covered by shields or protectors, or by the use of live-line tools not requiring linemen to go between live wires.

⑥ May be reduced to 30 in for supply neutrals meeting Rule 230E1 and cables meeting Rule 230C1 where the supply neutral or messenger is bonded to the communication messenger.

⑦ The greater of phasor difference or phase-to-ground voltage; see Rule 235A3.

⑧ *Example:* For a 50 kV-to-ground conductor above a 22 kV-to-ground conductor, the required clearance is 16 in + 25 in = 41 in when the conductors are 180° out of phase.

⑨ *Example:* For a 50 kV-to-ground conductor above a 22 kV-to-ground conductor, the required clearance is 40 in + 25 in = 65 in when the conductors are 180° out of phase.

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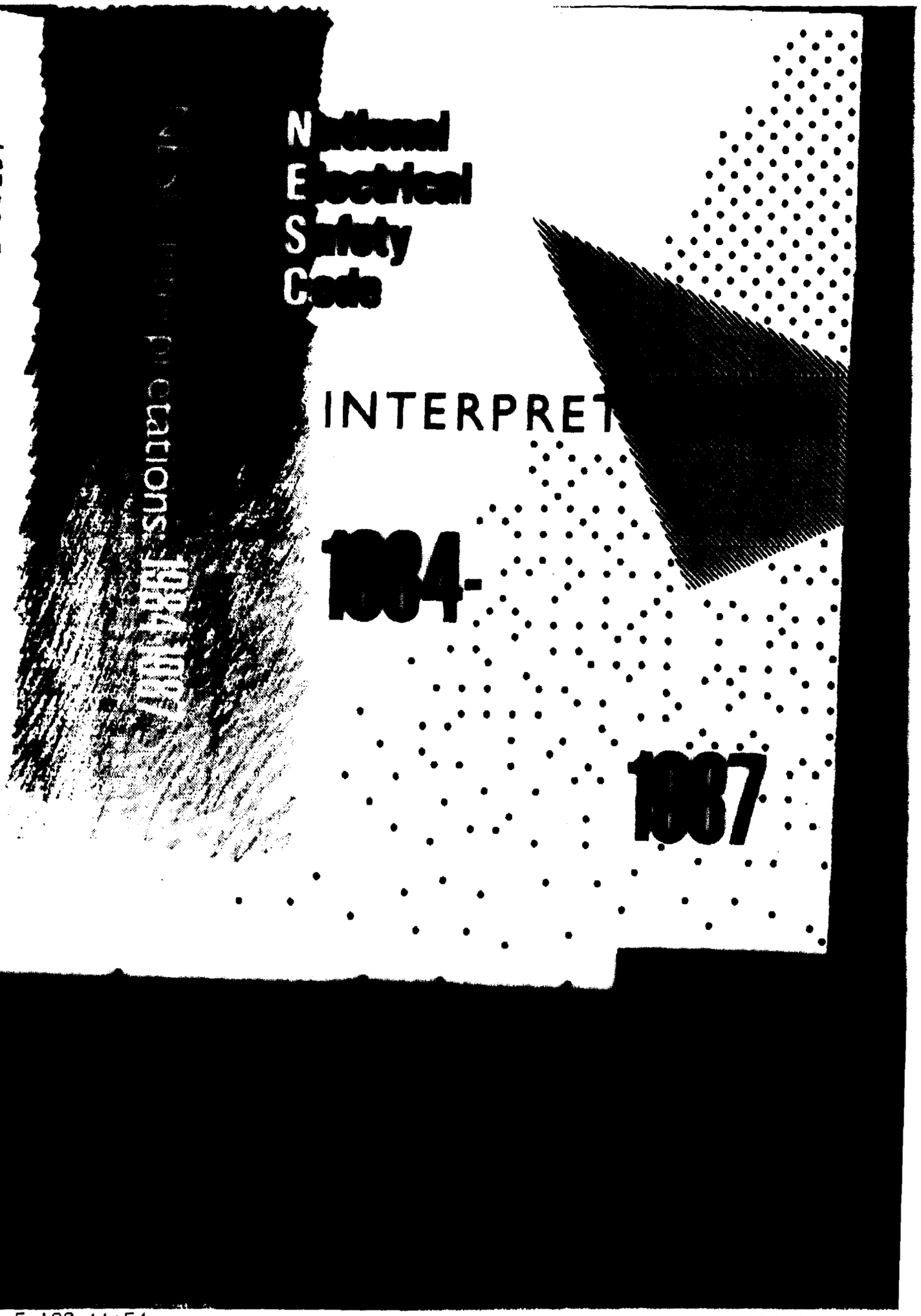

18, 86)

ation equipment to "that which operates
)0 V to ground or 750 V between any two
e transmitted power of which does not
operates at less than 150 V, regardless of
lephone relay referenced in Situation A is
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e 240 V circuit of the city relay of Situa-
f 150 W, as it would appear that it does,
nd siren are considered as supply equip-
n clearance between supply equipment,
and siren, and the communication relay,
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must meet Rule 237C. If, however, the
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trol relay are considered as communica-
from either of them to supply facilities

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quired to meet clearances of Rule 238
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must meet Rules 236D and 237C.

IR 362

a) IR 392

238A,B, Table 238-1

Spacing required between noncurrent carrying parts of adjacent supply and communication circuits

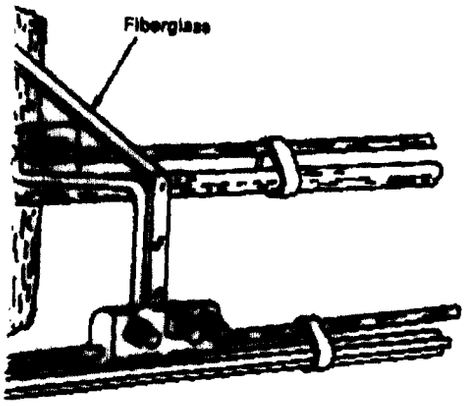
REQUEST (Apr 28, 86) IR 388

The subject of IR 268 is the tubular epoxy extension arm that is finding use as a means of providing additional pole space for CATV installations. My question concerns the last sentence in IR 268, which discourages installation by communications workers.

The tubular arm can be as long as 36 in and is often installed well into the clearance space. It also has metallic conductive end fittings; hence, I agree that communications workers should leave the installation to power utility workers or electricians, as suggested.

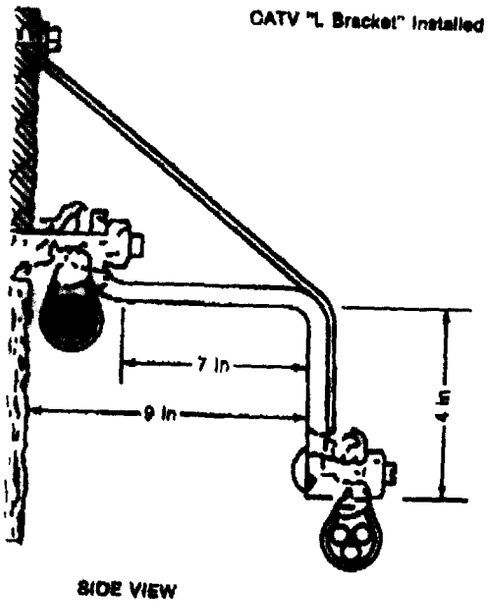
The CATV bracket with which I am concerned is shown in Fig IR 388. The reinforcing strap, which extends only 6 in into the clearance space, is fabricated of non-conductive fiberglass. Since it is affixed to the communication pole attachment, its depth of penetration into the clearance space is of necessity limited. The projected length of the strap is only about 12 in. Obviously this strap can be installed from the same position that the craftsman would be in to do his routine work on communications plant, and for this reason I believe it can be safely installed by a communications worker.

Am I correct in my opinion that communications workers can safely make the installation because of the significant differences between it and the tubular extension arm?



FRONT VIEW

CATV "L Bracket" Installed



SIDE VIEW

Fig IR 386-1

INTERPRETATION (Aug 11, 86)

It is intended that no communication equipment such as described in your interpretation request be installed closer than 40 in measured vertically to an ungrounded supply conductor or part. It is vital to the safety of communication line workers to provide adequate headroom for their work. Experience has shown that, just because such a bracket can be installed from a lower position, it does not follow that the bracket will always be installed from the lower position. In fact, it could be expected that a worker might go up each pole to preinstall the brackets before pulling the cable; in that case, the worker might be expected to go up as high as would make installing the bracket the most comfortable—ie, too high if the clearances required by Rule 238B are not met in full. Therefore, the full 40 in is needed vertically below the level of any ungrounded supply conductors to the level of any communication equipment, including the bracket that you described.

238B

Vertical clearance between supply conductor and communication cable attachment hardware

REQUEST (Apr 22, 86) IR 387

Please provide an interpretation of the applicability of NESC Rule 238B to the utility pole construction shown in Fig IR 387. The sketch shows typical construction, which would seem to satisfy NESC requirements on vertical separation of communication and power attachments as specified in Rule 235C, and also the requirements for climbing and working space specified in Sections 236 and 237.

The question arises whether Rule 238B, requiring 40 in of vertical space between power and communications conductors, would in fact apply in this case between the lowest power jumper off the arm end rack and the communications cable at the pole. Typically, in this area, the length of the jumpers below the end rack vary from 2 in to 18 in and are usually #4 to #1/0 solid aluminum or #6 solid copper that would not be prone to appreciable movement in the wind.

If Rule 238B does apply here, where the jumpers are 36 in horizontally off the pole, at what point (4 ft, 6 ft, 8 ft, 10 ft, etc), would the rule no longer apply?